CLAIMS

What is claimed is:

1. A receiver adapted for use in a communication system, wherein the communication system includes at least one transmitter and at least one receiver, and wherein data is received by the receiver in a received signal having a received frequency within a received frequency band, and wherein the received signal comprises a wanted signal having a first wanted frequency within a first wanted frequency band and an interference signal having an interference frequency within the received frequency band, and wherein the first wanted frequency band is between a lower wanted frequency and an upper wanted frequency, and wherein the wanted signal is centered about a first wanted frequency band center frequency, the receiver comprising:

   (a) a tuner, adapted to receive the received signal, wherein the tuner outputs a first intermediate frequency signal (IF), and wherein the IF has a first intermediate frequency signal band (SB) and is centered about a first intermediate center frequency (IF1); and

   (b) an analog-to-digital converter (ADC), coupled and responsive to the tuner, wherein the ADC samples and downconverts the IF and outputs a downconverted signal, and wherein the ADC has a sampling rate (SR) that is less than twice the upper wanted frequency, and wherein the sampling rate is selected so that a degree of aliasing of the interference signal into the first wanted frequency band after downconversion is maintained below a predetermined threshold.

2. The receiver as set forth in Claim 1, wherein the tuner downconverts the received signal into the first intermediate frequency (IF) signal using a mixer.

3. The receiver as set forth in Claim 1, wherein the tuner attenuates a plurality of extraneous signals having frequencies outside of a selected channel width (CW).

4. The receiver as set forth in Claim 3, wherein the selected channel width (CW) is approximately centered at IF1 and ranges approximately between (IF1-½*CW) and (IF1+½*CW).

5. The receiver as set forth in Claim 4, wherein the sampling rate (SR) of the ADC is specified so that CW is within a sampling rate range that ranges from a lower limit to an upper limit, and wherein the lower limit is approximately (k-½)*SR; and wherein the upper limit is approximately k*SR, and wherein k is an integer value.

6. The receiver as set forth in Claim 5, wherein the downconverted signal comprises a reflected CW that ranges approximately between 0 and ½*SR.

7. The receiver as set forth in Claim 5, wherein the IF1 is separated from the upper limit by a frequency separation (FS1), and wherein the FS1 is approximately equal to (k*SR-IF1).

8. The receiver as set forth in Claim 7, wherein the downconverted signal is mixed with a complex carrier signal having a frequency that approximates FS1.

9. The receiver as set forth in Claim 4, wherein the sampling rate (SR) of the ADC is specified so that k*SR falls within the channel width, and wherein the sampling rate falls outside of the first intermediate frequency signal band.

10. The receiver as set forth in Claim 9, wherein the IF1 is separated from k*SR by a frequency separation (FS2), and wherein the FS2 equals approximately (k*SR-IF1).

11. The receiver as set forth in Claim 10, wherein an unwanted frequency is present at (IF1+N), and wherein the receiver maintains the following condition:

$(N-FS2) + \Delta < (FS2-SB*½)$;

wherein Δ is an allowed frequency offset; and wherein

N is IF1 subtracted from the unwanted frequency.

12. The receiver as set forth in Claim 10, wherein an unwanted frequency is at (IF1+N), and wherein the receiver maintains the following condition:

$(FS2+SB*½) + \Delta < ½*SR$;

wherein Δ is an allowed frequency offset.

13. The receiver as set forth in Claim 4, wherein the sampling rate (SR) is specified so that the selected CW falls within a sampling rate range between a lower limit and an upper limit, wherein the lower limit is approximately equal to k*SR, and wherein the upper limit is approximately equal to (k+½)*SR, and wherein k is an integer value.

14. The receiver as set forth in Claim 13, wherein the downconverted signal comprises a reflected CW ranging between approximately 0 and ½*SR, and wherein the IF1 is separated from the upper limit by a frequency separation (FS1), and wherein the FS1 equals approximately (IF1-k*SR).

15. The receiver as set forth in Claim 1, wherein the receiver further comprises a demodulator, coupled and responsive to the downconverted signal, wherein the demodulator is capable of removing a COFDM modulation from the downconverted signal and outputting a suitable output signal.

16. The receiver as set forth in Claim 1, wherein the tuner comprises a first mixer coupled to a band-pass filter, wherein the first mixer is coupled to the received signal and a first local oscillator signal, and wherein the first mixer downconverts the received signal into the first intermediate frequency signal and inputs the first intermediate frequency signal to the band-pass filter.

17. The receiver as set forth in Claim 16, wherein the band-pass filter attenuates a plurality of extraneous signals having frequencies that fall outside of a channel width (CW), and wherein the band-pass filter outputs the first intermediate frequency signal.

18. The receiver as set forth in Claim 1, wherein the receiver further comprises a first automatic gain control (AGC) device, coupled and responsive to the first intermediate frequency and the ADC, and wherein the first AGC device maintains a signal level of the first intermediate frequency, and wherein the first AGC device outputs a maintained intermediate frequency to an input of the ADC.

19. The receiver as set forth in Claim 1, wherein the receiver further comprises a filter adapted to receive the downconverted signal, wherein the filter removes unwanted components from the downconverted signal and outputs a second intermediate frequency signal having a second intermediate center frequency (IF2).

20. The receiver as set forth in Claim 19, wherein the filter comprises a second mixer coupled to a low-pass filter, wherein the second mixer is coupled to the downconverted signal and a second local oscillator signal, and wherein the second local oscillator signal has a frequency approximately equal to the IF2, and wherein the second mixer downconverts the downconverted signal into the second intermediate frequency signal and outputs the second intermediate frequency signal to the low-pass filter.

21. The receiver as set forth in Claim 20, wherein the band-pass filter attenuates a plurality of extraneous signals having frequencies that are above a predetermined frequency, and wherein the band-pass filter generates the second intermediate frequency signal.

22. The receiver as set forth in Claim 19, wherein the receiver further includes a second automatic gain control (AGC) device, coupled to the second intermediate frequency signal, wherein the second AGC device amplifies the second intermediate frequency signal and outputs an amplified second intermediate frequency signal.

23. The receiver as set forth in Claim 19, wherein the receiver further includes a demodulator, coupled to the second intermediate frequency signal, wherein the demodulator removes COFDM modulation from the second intermediate frequency signal and outputs an output signal.

24. A communication system including at least one transmitter and at least one receiver, wherein data is received by a receiver in a received signal, wherein the received signal comprises a wanted signal having a first wanted frequency in a first wanted frequency band and an interference signal having an interference frequency within a received frequency band, and wherein the first wanted frequency band ranges between a lower wanted frequency and an upper wanted frequency, the communication system comprising:

(a) at least one transmitter; and

(b) at least one receiver comprising:

(1) a tuner, adapted to receive the received signal, wherein the tuner outputs a first intermediate frequency signal (IF), and wherein the IF has a first intermediate frequency signal band (SB) and is centered about a first intermediate center frequency (IF1); and

(2) an analog-to-digital converter (ADC), coupled and responsive to the tuner, wherein the ADC samples and downconverts the IF and outputs a downconverted signal, and wherein the ADC has a sampling rate (SR) that is less than twice the upper wanted frequency, and wherein the sampling rate is selected so that a degree of aliasing of the interference signal into the first wanted frequency band after downconversion is maintained below a predetermined threshold.

25. An apparatus for receiving radio frequency signals in a communication system, wherein data is transmitted to the receiving apparatus in a received signal, wherein the received signal comprises a wanted signal having a first wanted frequency within a first wanted frequency band and an interference signal having an interference frequency within a received frequency band, and wherein the first wanted frequency band ranges between a lower wanted frequency and an upper wanted frequency, the apparatus comprising:

(a) means for receiving the received signal and outputting a first intermediate frequency signal (IF); and

(b) means, coupled and responsive to the receiving means, for sampling and downconverting the first intermediate frequency signal and outputting a downconverted signal, wherein the sampling and downconverting means have sampling rates that are less than twice the upper wanted frequency, and wherein the sampling rates are selected so that a degree of aliasing of the interference signal into the first wanted frequency band after downconversion is below a predetermined threshold.

26. The apparatus as set forth in Claim 25, wherein the apparatus further comprises a demodulation means, coupled and responsive to the sampling and downconverting means, for removing a COFDM modulation from the downconverted signal and outputting a suitable output signal.

27. The apparatus as set forth in Claim 25, wherein the receiving means further comprises a first automatic gain control (AGC) means having an input that is adapted to receive the first intermediate frequency, wherein the AGC means maintains a signal level of the first intermediate frequency and outputs a maintained intermediate frequency to an input of the sampling and downconverting means.

28. A method of receiving radio frequency signals in a communication system, wherein the communication system includes at least one transmitter and at least one receiver, and wherein data is received by the at least one receiver in a received signal, and wherein the received signal comprises a wanted signal having a first wanted frequency within a first wanted frequency band and an interference signal having an interference frequency within the received frequency band, wherein the first wanted frequency band ranges between a lower wanted frequency and an upper wanted frequency, the method comprising the steps of:

(a) converting the received signal into a first intermediate frequency signal (IF), wherein the IF has a first intermediate frequency signal band (SB) and is centered around a first intermediate center frequency (IF1); and

(b) downconverting the IF at a sampling rate that is less than twice the upper wanted frequency, wherein the sampling rate is selected so that a degree of aliasing of the interference signal into the first wanted frequency band after downconversion is maintained below a predetermined threshold.

29. The method of receiving radio frequency signals as set forth in Claim 28, wherein the converting step (a) comprises the sub-steps of:

(1) receiving the received signal; and

(2) mixing the received signal with a local oscillator signal.

30. The method of receiving radio frequency signals as set forth in Claim 28, wherein the converting step (a) comprises filtering the received signal to produce a filtered received signal, wherein the filtered received signal has a channel width (CW) that is approximately centered at IF1 and ranges between approximately (IF1-½*CW) and (IF1+½*CW).

31. The method of receiving radio frequency signals as set forth in Claim 30, wherein the sampling rate is specified so that the CW falls within a sampling rate range that ranges between a lower limit and an upper limit, and wherein the lower limit is approximately (k-½)*SR, and wherein the upper limit is approximately k*SR, wherein k is an integer.

32. The method of receiving radio frequency signals as set forth in Claim 30, wherein the sampling rate (SR) is specified so that k*SR falls within the channel width, and wherein the sampling rate falls outside the first intermediate frequency signal band.

33. The method of receiving radio frequency signals as set forth in Claim 30, wherein the sampling rate (SR) is specified so that the CW falls within a sampling rate range that ranges between a lower limit and an upper limit, and wherein the lower limit is approximately k*SR, and wherein the upper limit is approximately (k+½)*SR, wherein k is an integer.